Claims

We claim:

1. A method for increasing transmit diversity gain in a wireless communication system including a transmitter with a plurality of antennas and a receiver with one antenna, comprising:

measuring a phase of each of a plurality of signals received by the antenna in the receiver;

selecting one of the plurality of signals as a reference signal;

determining, independently for each other signal with respect to the reference signal, feedback information indicating a required rotation of each other signal so that a phase of each other signal is within an identical quadrant as the phase of the reference signal;

sending the feedback information for each other signal to the transmitter;

phase rotating, in the transmitter, each other signal according to the corresponding feedback information to produce a rotated signal; and

transmitting the reference signal and each rotated signal to the receiver.

2. The method of claim 1, in which the reference signal is selected randomly from the plurality of signals.

3. The method of claim 1, further comprising:

measuring a power of each of the plurality of signals; and

selecting a highest power signal as the reference signal.

4. The method of claim 1, in which the transmitter has two antennas, and the feedback information is one bit.

5. The method of claim 4, in which a space encoding vector is $\mathbf{p}_k = [1, (-1)^{b_k}]$, where $b_k \in \{0,1\}$ is the feedback information sent from the receiver.

6. The method of claim 1, in which the transmitter has more than two antennas, and the feedback information is two bits for each other signal.

7. The method of claim 6, in which a space encoding vector is $\mathbf{p}_k = \left[1 \quad \exp[\frac{i \cdot q_2(k)\pi}{2}] \quad \cdots \quad \exp[\frac{i \cdot q_M(k)\pi}{2}]\right]$, where $i^2 = -1$, and $q_m(k) \in \{0,1,2,3\}$ is the feedback information sent from the receiver, for $m = 2,3,\cdots,M$, and $q_1(k) = 0$, for $\forall k$.

8. The method of claim 1, further comprising:

normalizing the quadrant to the phase of the reference signal.

9. The method of claim 8, in which the phases of the other signals with respect to the phase of the reference signal are $\tilde{\theta}_m = \theta_m - \theta_1 + 2l\pi$, where an integer l is selected such that each normalized phase $\tilde{\theta}_m$ is in a range of $[0, 2\pi)$.

10. The method of claim 1, in which the receiver is a cellular telephone.

11. A system for increasing transmit diversity gain in a wireless communication system, comprising:

a receiver including one antenna, and further comprising:

means for measuring a phase of each of a plurality of signals received by the one antenna;

means for selecting one of the plurality of signals as a reference signal;

means for determining, independently for each other signal with respect to the reference signal, feedback information indicating a required rotation of each other signal so that a phase of each other signal is within an identical quadrant as the phase of the reference signal; and

a transmitter with a plurality of antennas, and further comprising:

means for receiving the feedback information;

means for phase rotating each other signal according to the corresponding feedback information to produce a rotated signal; and

means for transmitting the reference signal and each rotated signal to the receiver.